How good are tests for E. coli in streams?

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Bacteria commonly used to indicate health risks in recreational waters might not be so reliable after all. Pathogenic E. coli were pervasive in stream-water samples with low concentrations of fecal indicator bacteria.

This is one of the unexpected findings from recent research that may affect how researchers and resource managers rely on indicator bacteria to determine if water is contaminated with bacteria that can make people sick. Although harmless themselves, fecal indicator bacteria such as nonpathogenic forms of E.coli, enterococci, and fecal coliform bacteria have long been used as an easy-to-measure surrogate to determine if pathogens are present.

"We saw little relation between pathogenic E. coli and fecal indicator bacteria criteria for recreational waters," said Joseph Duris, U.S. Geological Survey (USGS), Michigan Water Science Center scientist who led the study. "This is intriguing because we rely on indicator bacteria to tell us whether or not the water could make people sick," said Duris, whose study was published in the September-October issue of the *Journal of Environmental Quality*.

For this study, scientists collected water samples from 41 river sites in Michigan and Indiana from 2001-2003 and measured fecal indicator bacteria concentrations and markers of pathogens. Scientists grouped samples on whether or not they met recreational water quality criteria. The frequency of pathogen detection was compared between the sample groups.

Among the key findings:

- Gene markers for pathogenic E. coli were pervasive in water from Michigan and Indiana streams even in water with low concentrations of fecal indicator bacteria.

- Water samples exceeding the fecal coliform criteria for recreational water were significantly more likely to contain two of the tested pathogen markers. But for the three other tested pathogen markers, there was no significant difference between the groups.

- There was no difference in the frequency of pathogen marker occurrence between groups based on exceeding the E. coli or enterococci indicator organism recreational water quality criteria.

In natural waters, low concentrations of fecal indicator bacteria, such as fecal coliform bacteria, E. coli and enterococci are presumed to indicate the absence of fecal inputs, and therefore, the absence of fecally-derived pathogens. However, the distribution of pathogenic bacteria in river systems and the relation of these bacterial pathogens to fecal indicator bacteria concentrations is poorly understood.

"We will need a more intensive study to determine what might be driving the relationship between fecal indicator organisms and pathogenic E. coli occurrence," said Duris, whose team of USGS microbiologists completed the study with funding provided in part by the USGS Toxic Substances Hydrology Program.

The USGS Michigan Water Science Center is involved in several other studies investigating the relation between pathogen occurrence and fecal indicator bacteria criteria. National studies to assess the impacts of non-

point source pollution are underway. Two regional studies are ongoing to investigate the occurrence of other bacterial pathogens including Salmonella, Shigella, and Campylobacter, and the pathogenic types of E. coli. Factors that could influence the occurrence of these pathogens in river systems, such as hydrology, season, land-use, and source are being investigated for relation with pathogen occurrence.

More information: The full article is available for no charge for 30 days following the date of this summary. View the abstract at jeq.scijournals.org/cgi/content/abstract/38/5/1878

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